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January 1st to 20th inclusive.

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⁎ *The above List is prepared from the Patent Records by Mr. T. Morgan, Secretary of the Inventors' Patentright Association, Limited.*

THE SUBSIDENCES AT BLACKHEATH.

About three years ago a large and deep hole, like an artificial shaft, suddenly appeared in the central part of Blackheath. Much curiosity was excited by the occurrence, and a careful investigation of the phenemenon might have led to interesting results, but the Metropolitan Board, as the authorities entrusted with the preservation of the heath, considered the subsidence to be a dangerous nuisance, and had it speedily filled up. Early in November last a new hole made its appearance considerably to the westward of the former one, and a few days later there was a third in the immediate vicinity of the first. These extraordinary occurrences attracted the attention of the Astronomer Royal, who possibly began to feel anxious for the security of the Observatory in Greenwich Park, that structure having its foundation in the same bed of gravel which forms the plateau of Blackheath. Sir George Airy accordingly communicated with the Metropolitan Board, suggesting that they should have the cause of these strange disturbances inquired into. The Board replied that they had no funds at their disposal for such a purpose, but there would be no objection to his making any investigation he thought desirable. Ultimately the question was brought before the Lewisham and Blackheath Scientific Association, and the council of that body at once voted a limited sum, to defray the cost of a preliminary examination. Operations were then commenced on the last of the three apertures. This was found to be very nearly circular, being 7ft. 8in. in its longest diameter, and 6ft. 9in. in the shortest, the sides going down vertically to a depth of 18ft. It had all the appearance of a well or shaft, and nobody seeing it would have doubted its being such if unacquainted with circumstances of its origin. When a few feet of the fallen earth at the bottom of the pit had been removed, the sides were found to recede, and the hole increased in diameter to 14ft., so that its entire form might be compared to the neck and shoulder of a bottle. Further proceedings are at present arrested, it being dangerous to proceed without an extensive resort to timbering, in order to sustain the overhanging mass of sand and gravel. In order to raise the funds necessary to carry on the exploration, the members of the association already named have held a conference with the West Kent Natural History Society, and a committee has been appointed to consider the best mode of proceeding, and to obtain an estimate of the probable expense. The subject is one of much scientific interest, and if the precise cause of these unusual subsidences should be discovered, the knowledge may be of practical value. It is fortunate thus far that none of the villa residences and other buildings which occupy the borders of the heath have been in any way affected.

Railway Accidents.—A fatal collision occurred recently on the Western Valley Railway. A train was travelling down the line near Coalbrook Dale, when, from some cause not yet ascertained, it ran into a number of empty trucks on a siding. The stoker was thrown from the engine and the driver was considerably scalded. Considerable damage was done to rolling stock. On the Whitby and Scarborough Railway, a train left the metals near Ferryhill, and the traffic to Spennymoor was only carried on by means of other trains at the point of the accident.—An accident occurred on the Great Northern Railway at Tuxford recently. A goods engine fouled the points and went off the rails, blocking the down line. No one was injured. The London express was delayed over an hour, and the Sheffield passengers had to be sent on to Manchester by a special train.

M. WIEDEMANNS' ELECTRIC PAPER.

Ordinary letter paper, if well heated and briskly rubbed with the hand or with a brush, acquires electric properies; it adheres to tables, walls, &c., and on contact with the hand it gives slight electric discharges, visible in the dark. But on taking Swedish filter paper, and submitting it to the treatment described below, its electric properties are greatly intensified, and sparks may be drawn from it several centimetres in length. The paper is steeped in a mixture of equal volumes of nitric and sulphuric acid, as in the manufacture of gun-cotton. The paper thus pyroxilised is washed with abundance of water, and dried. If laid on a sheet of waxed paper and rubbed briskly, it manifests energetic action, and may be used for the representation of almost all experiments in static electricity.—*Comptes Rendus.*

UNCERTAINTY OF BLOOD STAINS IN EVIDENCE.

The circumstantial evidence of minute blood stains in criminal cases has been made much of in several recent trials. The value of such evidence has been seriously questioned by Dr. Charles O. Curtman, who shows that even when the suspected blood has been proved to be unmistakably human, the accused may plead that the blood stains were caused by predatory insects. In his experimental investigations Dr. Curtman allowed mosquitoes to take their fill of human blood, then, after keeping them in close confinement for periods of varying length, he killed them and examined the blood.

In all cases, up to forty-eight hours after a meal, a large proportion of human blood corpuscles were unchanged and readily recognisable. The size and colour of the corpuscles of mosquito blood are very different from human. As the result of more than a hundred careful measurements, he gives the following sizes: Human blood (after imbibition by the mosquito) averages, in dilute glycerine, 1-3200 inch; in 80 per cent. alcohol, 1-4000 inch. Mosquito blood averages in dilute glycerine, 1-14,000 inch; in 80 per cent. alcohol, 1-18,000 inch. In the case of bed-bugs it was found that these insects digest blood much more rapidly than mosquitoes do. After twelve hours no trace of human blood was discovered.

New Invention.—A new and beautiful invention has lately been made and patented by Herr Krœger, of Glasgow, in preserving flowers and plants for decoration and ornament, of which we have seen some charming samples in form of splendid bouquets and of flowering plants in pots. There has hitherto been no difficulty in drying some kinds of flowers and leaves, but in the drying they lose their colour, and in the present mode of dyeing them they mostly lose their shape. To give them natural-looking colour, tint, and hue, and to preserve at the same time their real graceful shape, has been the difficulty which has now been entirely overcome by this new and, as we are told, inexpensive process, by which almost every kind of flower is preserved in its normal shape, and a natural-looking and brilliant, but subdued colour given them. We see roses, light, dark, and shaded, in their natural lovely form, likewise fuchsias, hyacinths, drops, even dahlias, and many other kinds of flowers, an *ensemble* so natural that our first impulse on seeing them is to smell. Thus, then, the number of kinds of flowers that now can be preserved and made use of for temporary or even permanent decoration is almost unlimited, and instead of having to content ourselves in future for winter decorations with those mostly unnatural and stiff-looking everlasting flowers and grasses, we may have on our table bouquets which may vie for months, for years even, with bouquets of flowers fresh from the garden or the conservatory.

Reviews.

YATES ON BREAD REFORM.

"Bread Reform League. Wheat-Meal Bread." By M. Yates, Hon. Secretary; Member of the Ladies' Sanitary Association. London: Jarrold & Sons, Paternoster Buildings.

The subject to which this little book refers is one of considerable importance, for it is now quite clear that bread made of whole-meal wheat is more nutritious and healthy than the beautiful white flour loaves which are so generally prized.

To understand the meaning of this work anyone ought to read it through, but we may, perhaps give some notion of its contents by the following quotation:—

It is the substance called gluten, of which there is such a large proportion in wheat-meal flour, that makes wheat superior to every other grain as a bread-cereal. You can separate gluten by tying a bit of dough in a linen bag and kneading it in cold water. A white powdery substance exudes which sinks to the bottom when the water is at rest—this is starch. There remains in the bag a greyish-white gluey substance—this is gluten. Gluten renders wheat-flour easily convertible into a light elastic dough. When flour and water are mixed with yeast and set in a warm place, the heat and the action of the yeast turn part of the starch contained in the flour into sugar. The sugar fermenting produces bubbles of carbonic acid gas. The sticky nature of the gluten prevents them escaping; they are, therefore, held in, and the bread 'rises,' as it is usually expressed, and the whole mass becomes porous and light.

Liebig states that whole-meal bread contains about 60 per cent more phosphatic salts than meat, and 200 per cent more than white bread. It is the phosphatic salts that make bones and teeth; and the reason there are so many ricketty children and so many people with bad teeth, is because their food is deprived of the lime-salts, &c., really required for the growth of the human bones and teeth. Everyone who keeps poultry knows that unless you give them sand and chalk, they will lay eggs with soft shells, because their food does not give them the materials requisite for making shells. Those races of people who have been brought up on wheat-meal bread, fruit, and vegetables, have much better teeth than those who live principally on fine white bread and meat. Wheat-meal bread also contains every element necessary for the nourishment of the tissues; and history shows that people feeding on the impoverished and deteriorated white flour are more subject to consumption and other wasting diseases, and thus suffer the punishment that inevitably follows disregard of nature's laws.

It is requisite for a child to grow up strong and keep in good health that its food should produce muscular flesh, bone, and heat. It is perfectly possible for a child to eat what will satisfy hunger, and yet die of starvation. If you attempt to feed a child with the expectation of its living, on corn-flour (which is pure starch) made up with water, it would die of starvation only a little later than if it ate nothing. Of course if you mix it with milk, which, like wheat-meal bread, contains everything necessary to sustain life, that is quite a different thing; but it is the milk that nourishes the body, not the starch, which in itself only gives heat. It is, then, distressing and wasteful of money to attempt to bring up children, expecting them to thrive on white bread, which is nearly all starch, when you can obtain a bread containing so much more nourishment and everything requisite to make a child grow up strong and healthy for the same money as is paid for white bread, which as I repeat again to impress the fact strongly, is nearly all starch. Why in our craze for white bread should we raise so many feeble, nervous, undersized children, upon an impoverished flour because it looks white and light? The whiter the bread the more starch it contains, and therefore the less nourishment. In fact, the whiteness of the bread may be considered an outward sign of the starvation within. When we know that it is the food which continually builds up the body and keeps it in health, how can we expect to rear anything else than sickly children upon a diet incapable of forming healthy blood? White bread is good as a change or as a luxury. but if you live on it, you must necessarily also take a large quantity of milk, eggs, or meat, and you will suffer no disadvantage. But milk, eggs, and meat are costly. It will be realised what a very expensive food meat is when it is remembered that about one-fourth is always lost in roasting, so that you must calculate that for every four pounds of meat you eat, you pay for five pounds, besides the bones, which have comparatively little nourishment except for soups. Even when cooked, meat has 17 per cent more water than bread. When you buy a pound of beef at 1s. per pound, you pay nearly eightpence for pure water.

G. A. ROWELL ON ELECTRIC METEOROLOGY.

"An Endeavour to show the General Agency of Electricity in the Cause of Rain and its Allied Phenomena; with an appeal for the consideration of the theory advanced." By G. A. Rowell, Honorary Member of the Ashmolean Society, Assistant in the Oxford University Museum, Author of "An Essay on the Beneficent Distribution of the Sense of Pain," &c. Oxford: Slatter & Rose, High-street.

Our well-known friend Mr. Rowell again presents us with his views on his meteorological theory on all points and subjects to which it relates; but, from the task being heavier than anticipated, and to avoid delay, he has restricted it to the cause of rain and allied phenomena, and as such he respectfully submits it for consideration. Still he hopes to do the like as regards the cause of storms, the Aurora Polaris, and some points of terrestrial magnetism; but for the present he can only refer to some of his papers on these subjects. Of course a good idea of Mr. Rowell's views can only be obtained by perusing the book itself, but some idea may be gathered from the following quotation:—

"The opinion I now hold, that bodies attract electricity in accordance to their temperature, I believe is new, and as this is an important feature in my theory it seems necessary that I should show the grounds for my opinion and the correction of my theory on the point. Evaporation increases with an increase of temperature, and it is certain that electricity goes off with vapours at all temperatures, being, on my views, the evaporating power. It is also certain that to render a particle of water (vapour) buoyant at a great, or, in fact, at any height, it must from some cause occupy a vastly increased space. Now I cannot conceive the possibility of such minute particles expanding in any great degree, as they must be almost all surface; but it is evident that they could be rendered buoyant by such an imponderable coating as electricity might give. Evaporation increases with the temperature, and vapour and clouds differ greatly in their elevations, and it seems to me, on this and other points, that there must be some increase in the buoyant power with the increase of temperature. Vapour or steam to our sense of feeling, is in accordance with the water from which it is generated up to the boiling heat, when it is scalding hot, but if from water under a far higher temperature under pressure, the steam is cool, and the hand may be held with impunity in the steam as it escapes with violence from a boiler. Can any more reasonable explanation be given in this case than that the particles of vapour are enveloped in the coatings of electricity which they take up in accordance with their excessive temperature, and that the electricity, and that alone, comes in contact with the hand the steam impinges on? High-pressure steam is dry, doubtless from the particles being kept apart by their coatings of electricity.

The only explanation apart from my own I have met with on the non-scalding properties of super-heated steam, has been that it results from the cooling effects of its expansion on its escape from the boiler; but in super-heated metals we have similar results, and no such expansion or diffusion; these, therefore, are otherwise accounted for. In my early days it was common for men, or sometimes women, to attend fairs and public places and perform the feat of licking a red-hot poker, or walking on red-hot ploughshares."

We think everyone, after perusing the above will be disposed to agree that this work is suited for perusal, and Mr. Rowell's views are worthy of support.

A POET'S OFFERING.

Thy gentle hand the flowers will take,
Which blossom still for thy dear sake.
Whose petals, opening full and free,
Will give their sweetest scents to thee!
And if they bloom before thy eyes,
'Tis not therein the virtue lies!
But beauty striving thine to vie,
To seek to shine where sweeter lie!
And if they pine in death's decay;
'Tis that they've breathed their charms away,
In vain endeavour thine to meet,
Then falling, grace thy fairy feet!
But yet, methinks, if I could take
The faded leaves thou may'st forsake,
And place them where I gaze on thee;
Their scents, once thine, would pass to me!

Henry George Hellon.

Siemens' Electric Light.—Dr. Werner Siemens has made another useful application of the dynamo-electric current to the performance of mechanical work. Hydraulic lifts are costly to install and maintain, so he has invented an ingenious electric lift, which has been exhibited recently at the Mannheim Industrial Exhibition, where in the course of a few weeks it conveyed over 8,000 persons at a speed of 1½ ft. per second. The lift is quite safe, the carriage being suspended by two wire ropes, which pass over drums at the upper terminus, and carry counterweights at their ends, which equilibrate the average burden to be borne. To raise or lower the lift, therefore, only a slight additional power is required. This is supplied in the form of an electric current from a dynamo-electric generator on the ground, and it is conducted to a second dynamo machine attached to the carriage. The propulsion is effected by means of a metal ladder or rack which runs up the middle of the "shaft" or passage of the lift, and into this rack work two toothed wheels carried by the lower part of the framework of the carriage. These wheels are driven by the revolving armatures of the dynamo machine on the car by means of an endless screw. The current is led from the stationary generator to the moving one by conductors running up the sides of the ladder and two metal rollers which make contact with them, and are connected to the armature of the machine. The return part of the circuit is formed by the metal wires which hang the carriage. In hotels and such places, for the conveyance of persons and luggage, this electric lift is likely to be useful; but for mercantile purposes it would be advisable, perhaps, to modify it, and replace the ladder arrangement by a wire rope and winch driven by the current.—*Engineering.*

THE BILL FOR THE AMENDMENT OF THE PATENT LAWS.

THE Bill brought into the House of Commons by Mr. Anderson, Mr. Alexander Brown, Mr. Hinde Palmer, and Mr. Broadhurst, M.P.'s, for the amendment of the law as to Patents for Inventions, is as follows :—

"Whereas Letters Patent are now granted and regulated under the following Acts: fifteenth and sixteenth Victoria, chapter eighty-three; sixteenth and seventeenth Victoria, chapter five; sixteenth and seventeenth Victoria, chapter one hundred and fifteen; and twenty-second Victoria, chapter thirteen; and it is desirable to amend these, as regards the appointment of paid Commissioners, duration and costs of patents, and in other matters:

"Be it enacted by the Queen's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal and Commons in this present Parliament assembled, and by the authority of the same, as follows:

"1. This Act shall come into operation on the 1st day of January, 1882.

"2. Her Majesty may, from time to time, by warrant under her sign manual, on the recommendation of the Lord Chancellor, appoint an officer to be called the Chief Commissioner of Patents for Inventions, and on the recommendation of the President of the Board of Trade, two officers, to be called respectively Second and Third Commissioners of Patents for Inventions; and these officers shall hold their offices during Her Majesty's pleasure.

"3. The Treasury may fix the salaries for these three Commissioners at such annual sums as it deems proper, but not exceeding, for the first Commissioner £1,500, for the Second Commissioner, £1,200, and for the Third Commissioner £1,000; and the Treasury may also provide such further moderately paid assistance as may be found necessary for carrying on the work of the office, but as far as possible continuing those now employed. All payments under this section to be out of moneys to be provided by Parliament.

"4. It shall be the function of these three paid Commissioners to do all the duty hitherto performed by the unpaid Commissioners and the Law Officers, whose duties shall thereupon cease, to take over the establishment from them, and to manage all the business of the Patents for Inventions Office of the United Kingdom, and to perfect its organisation; more particularly in the matter of a library of records and registers, so indexed and arranged as to facilitate searches, and to be easily accessible to the public under such reasonable regulations, and small fees as the Chief Commissioner with approval of the Lord Chancellor may from time to time prescribe.

"5. Letters Patent for Inventions shall be granted for a period of twenty-one years from the date of application, subject to a payment at the end of the seventh, and at the end of the twelfth, and at the end of the seventeeth years respectively, as prescribed in the Schedules appended to this Act; and the provisions of this section shall apply also and equally to inventions (including foreign inventions) that may have been previously patented abroad.

"6. Letters Patent for Inventions granted prior to the commencement of this Act, and then in force, shall be exempted from the payments formerly prescribed at the end of the third year and at the end of the seventh year, so far as these payments have not become due at the commencement of this Act, and shall thereafter be liable only to the payments prescribed in the Schedules appended to this Act, and at the end of the twelfth year may be extended to twenty-one years, subject to payment of the sums prescribed in said Schedules.

"7. After a patent shall have been sealed, the failure to pay the stipulated duty at any of the subsequent terms when due shall not invalidate the patent, provided at some period before the expiry of twelve calendar months after such due date the duty shall have been paid, together with such amount of fine as is specified in the appended Schedule of fines for postponed payments, but failing that the patent becomes void.

"8. There shall be paid to and for the use of the Crown on the several instruments described in the appended Schedule the duties and fines mentioned in those Schedules and no others.

"9. The term for provisional protection shall henceforth be extended to twelve months, and the patent when sealed, shall date as of the day on which the petition for Letters Patent was left at the Office of Patents for Inventions by the applicant.

"At any time subsequent to the sealing of a patent it shall be in the power of its owner to add to it such improvements as he may desire, unless the Chief Commissioner shall decide that the improvement proposed is not a legitimate addition to the patent, but is more properly the subject for a new patent. For every such addition to a patent, or procedure connected with such addition, there shall be paid one-half of the initial stamp duties, and subsequently one half of each stamp duty still remaining to be paid, as these may fall due on the original patent, or with proportionate fines for postponed payment. Any such addition to a patent shall expire along with the original patent.

"11. A patent shall have to all intents the like effect as against her Majesty the Queen, her heirs and succesors, as it has against a subject, but the Secretary of State of any Department may, with the consent of the Treasury, use for the public service any patented article, or any patented manufacturing process, on such terms as may be agreed on with the owner of the patent, or, failing such agreement, the Treasury and the owner shall each appoint an arbitrator, and the arbitrators shall appoint an umpire in event of disagreement, and the terms so arrived at shall be binding on both parties.

"12. Employment in the public service shall not preclude any person from taking out or owning a patent, or from any participation in the privileges of a patentee, but this provision shall not apply to any person employed in the Office of Patents for Inventions.

"13. The short title of this Act shall be the Patents for Inventions Act, 1881.

Schedule of Stamp Duties.

	£	s.	d.
On Petition for grant of Letters Patent	0	10	0
On certificate of record of notice to proceed	0	10	0
On warrant of Law Officer for Letters Patent	1	0	0
On the sealing of Letters Patent .	1	0	0
On the Specification	1	0	0
On Letters Patent at the end of seven years	20	0	0
On Letters Patent at the end of twelve years....	40	0	0
On Letters Patent at the end of seventeen years	40	0	0
On certificate of record of notice of objections	1	0	0
On certificate of every search and inspection	0	1	0
On certificate of entry of assignment or license	0	5	0
On certificate of assignment or license	0	5	0
On application for disclaimer	1	0	0
On caveat against disclaimer	1	0	0
On office copies of documents for every 90 words	0	0	2

On every addition to a patent one-half of the above stamp duties.

Schedule of Fines for Postponed Payments.

If paid within three months after due date, 25 per cent on the duty then due.

If paid not within three but within six months after due date 50 per cent on the duty then due.

If paid not within six but within nine months after due date, 75 per cent on the duty then due.

If paid not within nine but within twelve months after due date, 100 per cent on the duty then due.

On every addition to a patent, one-half of the above fines.

THE MANUFACTURE OF SULPHATE OF SODA, BY THE DIRECT PROCESS.

THE following paper read before the members of the Faraday Club, in Liverpool, December 15th, 1880, Andrew Ross Garrick, Esq., Ph. D., in the chair, by Mr. John Hargreaves, is of such importance that we place it before our readers :—

In compliance with the invitation of our Secretary, I have the pleasure of placing before you the following paper on the Manufacture of Sulphate of Soda by the Hargreaves and Robinson direct process.

This process was first brought before the public about ten years ago, and since that time has slowly but surely made its way, its superiority over the old process being now clearly established in every point.

As the chemistry of the process is so well known, I will confine myself exclusively to its technicalties.

The first working apparatus erected consisted of four brick chambers of 6-ft. cube. With this arrangement difficulties arose in consequence of leakage of the gases from one chamber to another without passing through the columns of salt, from the chambers into the flues, and *vice versa*. These, together with the leakage of air, necessitated a very large consumption of fuel. To overcome these evils a socond experimental apparatus—consisting of 4 cast iron cylinders, each 10-ft. diameter by 10-ft. high—was erected in a double line. This practically got rid of the leakage. But the small amount of material and the shortness of the column, together with a relatively large amount of radiating surface, showed the advisability of increasing the size of the apparatus. With this object two other cylinders of the same dimensions were added to the series. This addition, although giving improved results, still fell short of the object in view, and the cylinders were afterwards pulled down.

The next apparatus consisted of 8 cylinders of 12-ft. diameter, by 12-ft. high, which were erected in a single line; each cylinder having two fire places and two discharging doors placed on opposite sides. The sulphurous acid pipe was placed on one side, and the circulating pipe connecting each of the end cylinders on the other side of the line of cylinders.

This arrangement gave a long column of salt, but exposed too much cooling surface, and consumed more fuel than was desirable. But this was afterwards greatly reduced by erecting another line of eight cylinders so arranged as to form a double row with one fire-place and one discharging door to each cylinder. This reduced the fuel to about one-eighth of that previously required per ton of sulphate, for, while the production of the plant was doubled, the total fuel consumption was reduced to about one-fourth. This most remarkable result was another confirmation of the fact that the larger the quantity of material operated upon, the smaller the proportion of fuel required.

Four sets of plant, having a total of 38 cylinders of 15-ft diameter by 12-ft. high, were next erected by several firms. Each set was arranged in two rows with an archway betwixt, having two fires and two drawing doors to each cylinder for the convenience of quick discharging and re-heating. Twenty cylinders of the same size, but arranged back to back, and with only one fireplace and drawing-place to each cylinder, were afterwards erected by the Atlas Chemical Company. The working of these cylinders proved that it was quite practicable to discharge the contents of each through one drawing-door. All the foregoing experience pointed in the direction of still further increasing the dimensions of the cylinders and arranging the apparatus compactly, so as not to expose an excessive amount of radiating surface. Convinced of this fact, the same firm decided to erect another set of cylinders of larger dimensions than any yet attempted—viz., twelve cylinders of 18-ft. diameter by 12-ft. high, each containing 55 to 60 tons of sulphate. Several important improvements were introduced into this apparatus. In the previously erected plants the gas, after descending through the mass of partly-converted sulphate, was conducted from the bottom of each cylinder to the top of the next by means of an external pipe connected to the lower part of the cylinder. In this apparatus these external pipes are replaced by D shaped pipes arranged in the interior of the cylinders, by which leakage of air into the upcast pipe is entirely prevented, and besides, has the advantage of placing all the connecting joints at the top of the cylinders where they can be got at. The brickwork is also simplified, and now consists of a 9-in. ring around each cylinder, with an outer wall enclosing the whole series, the remaining spaces other than the fire-places and flues being filled up with concrete to prevent loss of heat. The hydrochloric acid is taken from the top of the circulating pipe through a movable wrought iron syphon to a pipe fixed above the two lines of cylinders. This has considerable advantages over the earlier system of taking the exit gases through the drawing-doors, and thence by an underground flue to the exhausters, as it effects considerable economy in the amount of iron used in construction, and decreases the number of joints.

This plant also contains the recently-improved firing arrangements, by which the heat from the fire-places is more evenly distributed, and local heating of the cylinders rendered almost impossible, no matter how carelessly the workman may fire.

Respecting the question of fuel required to maintain the temperature of the cylinders, I may here note that one of the best conducted plants is now fired almost exclusively, not with coal, but *cinders obtained by ridding the ashes from other furnaces in the works*, and of this inferior fuel less than 2½ cwt. is required per ton of sulphate made, and consequently the cost of repairs to fire-places is almost *nil*.

The salt was originally prepared by moistening with water, and forming into lumps by drying on floors heated from beneath, and afterwards broken into small pieces by a mill. This preparation is now performed entirely by machinery. The moistening is effected by the waste steam from the engine supplying the motive power. This steam passes into a box in which the salt is agitated by revolving arms. It then passes on to an endless band formed of a series of iron plates, where it is stamped and cut into suitable pieces. It then enters the drying oven, where, after being brought into direct contact with the products of combustion, it arrives at the other end in a suitable condition for putting into the cylinders. It is important that the prepared salt be sufficiently porous to allow the diffusion of the gaseous re-agents, and also free from dust, so as not to close the passages through which the gases circulate in traversing the cylinders.

The kind of salt varies with the purpose for which the sulphate is required. Ground rock, surface evaporated salt, sweepings from salt works, and other cheap sources of salt are largely used for the process where sulphate is made for Alkali Manufacture.

When it is required to use the sulphate without refining for the manufacture of plate glass, it is necessary to use salt containing only traces of iron.

The salt prepared by Mr. Otto Pohl's method works exceedingly well in the direct process. His system consists in evaporating the brine by bringing the products of combustion into direct contact with it in one vessel, while above there is a pan in which another quantity of brine is heated from below. It is found much more economical than the ordinary system of salt manufacture both as to fuel, labour, and working space, and hence, affords a supply of salt at much lower cost. I have here samples of this salt kindly furnished by Mr. Pohl.

Any carbonaceous matter contained in salt used for the direct process is quickly burnt out in the cylinders, leaving a perfectly white sulphate.

When a cylinder is filled with salt it is made the exit of the series, and quickly becomes elevated to a working temperature (which may be estimated at 400° C.) by the hot gas coming from the previous cylinders, and also by the action of the small fire attached. As soon as the formation of sulphate commences, the temperature rises rapidly, rendering the further application of external heat unnecessary until—in consequence of the small amount of chloride remaining—the heat, generated by chemical action, diminishes.

As the salt becomes converted into sulphate it is brought nearer and nearer to the source of sulphurous acid, the proportion of which passing the cylinder increases daily until it becomes the first cylinder in the series, when it receives the red hot gas coming direct from the burners, which quickly decomposes the remaining chloride.

The time occupied in decomposing the contents of a cylinder varies with the kind of salt and the size of the pieces employed, but under ordinary circumstance should not exceed 21 days, and has often been done in less than 14 days.

When the charge is decomposed the cylinder is isolated by closing the dampers connecting it with the sulphurous pipe and the succeeding cylinder, which latter in its turn is made the first in the series. The drawing-door is now opened, and the sulphate discharged; after which the cylinder is re-filled, and again made the last in the series.

The amount of cubic capacity required in the cylinder per ton of sulphate per week is about 170 to 180 cubic feet.

The pyrites burners, with the exception of being better protected against heat losses, are the same as used in the old process.

The draught from the burners is obtained by means of exhausters placed on the passage from the cylinders to the condensers. The waste steam from the engine driving these, after passing through a super-heating coil, heated by the waste products of combustion coming from the cylinder fires, is mixed with the sulphurous acid in the burners to supply the necessary water vapour for the decomposition of the chlorides. Besides being an economical source, this has the advantage of automatically regulating the supply of steam to the sulphurous acid, which must vary with the speed of the engine driving the exhausters.

Neither the hydrochloric nor sulphur acids have any appreciable effect upon the iron-work of the apparatus, as the temperature is always in excess of that required to keep them in the gaseous condition.

The condensers used are the same as in the old process, but, as the gas comes in a continuous stream, there is no necessity for the frequent variation of the supply of water to the condensers which is required to condense the acid from pots.

The advantages claimed are briefly as follows:—

1st.—Although the cost of apparatus is about the same as that required for the old process, there is this difference: That whereas the life of a vitriol chamber may be estimeted at—say ten years, the cylinders used with ordinary care in the direct system show every sign of lasting three times that period without renewal.

2nd.—Less fuel, being about one-half that required by the old process.

3rd—Less labour, and, with the exception of the burner men, and one intelligent person to look after the plant, no skilled labour is required. Hence, less difficulty in dealing with the workmen.

4th.—Less repairs. In the instance of one apparatus which has been working several years, I am informed that this item is less than 6d. per ton of sulphate made.

5th.—No nitrate of soda necessary.

6th—Cheaper qualities of salt—not available for the old process—are used.

7th.—Less sulphuric amongst the hydrochloric acid. Consequently less annoyance from sulphate of lime in the Weldon process.

8th.—No leakage of hydrochloric acid into the fire flues, the whole of it passing through the exhausters.

9th.—The sulphate when drawn emits no hydrochloric or sulphuric acid to annoy the workmen.

10th.—Sulphate is made containing only very small quantities of chloride and free acid, and, therefore, especially adapted for manufacture of 76 per cent. or other high strength caustic, for which it is largely used. The manufacturers, whilst guaranteeing this quality to contain less than 0·5 per cent. chloride of sodium, often supply it with less than 0·2, and even as low as ·05 per cent. chloride. I need hardly say that sulphate of such a quality commands a decided preference over that made by the old process, and in practice sells for about 2s. 6d. per ton over the ordinary market rate.

Sulphate made by this process is also used without refining for the manufacture of plate glass, and is superseding that of the old process, which has to be refined at an additional cost of 25s. and upwards per ton before it is fit for this purpose.

Lastly a reduced cost of production, which may be fairly estimated at 15 to 20 per cent.

In conclusion, the process is now rapidly extending. Eight sets of apparatus are now at work, three others are in course of construction, giving an aggregate capacity of production of about sixty-seven thousand tons per annum. Arrangements are also being made for the immediate erection of additional apparatus.

Agricultural Experiments.—A representative meeting of Sussex landowners and farmers was recently held at the Brighton Town Hall, the Rev. John Goring in the chair, to form an agricultural experimental association. Mr. Jamieson, F.C.S., explained the series of experiments which he had successfully carried out in Aberdeenshire for the past five years, and pointed out that the main object was to ascertain the manures which were the most profitable in connection with certain soils and certain crops. An association was formed with the Earl of Chichester as president and the Duke of Norfolk and Lord Leconfield as vice-presidents. A managing committee was elected, and it was resolved to engage Mr. Jamieson to carry out experiments at the stations on the Wealdon clay, on chalk, and on the Hastings sand; a fourth station was was left for future consideration. The estimated expenditure is £600 per annum, for a period of three years. The subscriptions received by Captain Sergison towards the guarantee and working funds amount to nearly £800, a large proportion of the subscriptions being for three years. The subscribers include the Duke of Norfolk, Lord Leconfield, Mr. H. Willett, Mr. R. Loader, M.P., and Sir Spencer Maryon Wilson, who have each given £50.

The Scientific Review

AND

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SESSION 1880—1881.

Members' Meetings at 8 p.m. on Thursdays, February 10th and 24th, Patent Question; March 10th and 24th; April 7th and 28th; May 12th and 26th; and June 9th.

Annual General Meeting, Thursday, May 26th, at 4 p.m., unless otherwise arranged.

Subscriptions are payable to Mr. G. A. STRETTON, the Receiver, 4, St. Martin's-place, S.W., who is the proper official to give receipts.

F. W. CAMPIN, Sec.

Proceedings of the Institute.

At the meetings held during the past month the business transacted was such as needed no public report.

Monthly Notices.

Death of Thomas Carlyle.—This celebrated author passed away from amongst us on Saturday, the 5th inst. He needs no eulogium of ours; hence this simple notice.

The death is announced, at Albizzate, of Baron Ercole Dembowski, an astronomer whose name is familiar to our readers. In 1852 he fitted up a private observatory at Naples for watching double stars. In 1860 he erected a new observatory in Lombardy, and quite retired from the world. He completely revised in 15 years the catalogues of Dorpat and Pulkovo. In 1878 he was awarded the gold medal of the Royal Society of London. Baron Dembowski was in his 70th year.

The Royal Commission appointed in 1879 to inquire into the cause of accidents in mines have concluded the taking of evidence. The attention of the Commission is now directed to a series of experiments as to the explosive nature of coal-dust, as to the best kind of safety-lamp, and as to other matters designed to elucidate the causes of explosions. It is proposed that some experiments shall take place to test the efficacy of the electric light as an illuminating power in mines.

A "Gold Institute," with three departments, chemical, mechanical, and practical, on the same lines as the Iron and Steel Institute is intended to be established. The new Institute, while recognising the maturity of the Society of Arts, which has been the fruitful mother of scientific and technically industrial offspring, will from the beginning have its own separate organisation. It will start, moreover, with the great advantage of a nucleus of a library and museum, Mr. Lock having offered his rare works in metallurgy and his illustrative collections of specimens as the first contribution.

An interesting discovery of a good deal of native crystalline sulphur, of recent formation, has been made during excavation in the Place de la République, in Paris. The substance (according to M. Daubree) has no connection with emanations of gas, but is evidently due to the simultaneous presence of the sulphate of lime, of plaster-rubbish, and of organic matters, plant *debris*, dung, skin, fragments of bones, &c. The spot is where part of the old trench or moat of the city existed; this was filled up about two centuries ago. The mineral consists of a breccia of thin fragments incrusted with crystalline sulphur, which cements them together. A similar case occurred in 1778, in demolition of the Saint-Antoine Gate.

Peat in Brittany.—At a recent meeting of the French Academy. M. De Molon made an interesting communication on the products of a peat found extensively in Brittany. This peat is characterised by the nature of the soil which bears it, and which consists of Cambrian granite and schists. It is formed chiefly of mosses (especially *Sphagna*). It yields, with suitable reagents, benzine, paraffin, fatty oils, phenols, resinous matters, sulphate of ammonia, crystallisable acetic acid, and (more particularly) 17 to 18 per cent. of a waxy substance, similar to resin, which furnishes, on distillation, a quantity of paraffin, sufficient to render its exportation industrially productive. M. De Molon further says this Brittany peat is a fuel of the first quality. If used to make gas, it gives results very superior to those obtained with coal, and realising an economy of 33 per cent.

A New Use of Electricity.—M. Grandt has constructed an apparatus for giving movement to ships. An ordinary steam-engine sets in action one or more electro-dynamic induction machines. The current is transmitted to a voltameter containing acidulated water which is decomposed into oxygen and hydrogen. These gases are conducted into a tube and escape by an aperture near the keel. A little above this aperture there are two platinum points isolated from each other and in communication with a Ruhmkorff's induction coil. When the gas escapes, a spark explodes it, and this explosion moves the ship.

Facts Towards the Study of the Formation of Fog.—M. Ch. Andre records an observation made at Mount Verdun, on Nov. 8 last. During the day the barometer was high, the temperature about 0°, and the wind blew with a feeble mean pressure. An intense fog covered the table-land of Verdun, occasionally dispersing to reappear after a short interval. The barometer fell whenever rain set in, but the fall was always sudden and generally accompanied by the dispersal of the fog. The rise was more gradual and was accompanied by the reappearance of the fog.

THE SCIENTIFIC REVIEW
AND
Scientific and Literary Review

FEBRUARY, 1881.

SOME IMPORTANT POINTS OF AMERICAN PATENT LAW.

THE patent laws of the United States provide for the reissue and correction of patents when the original is inoperative or invalid by reason of a defective or insufficient specification, or by reason of the patentee claiming as his invention or discovery more than he had a right to claim as new, provided it is shown that the error arose from inadvertence, accident, or mistake, without any fraudulent or deceptive intention on the part of the patentee.

The matter to be introduced into the amended specification is limited strictly to such as was clearly indicated, described, or suggested in the original specification, drawings, or model, and such as might have been lawfully claimed, but was not, for the reasons mentioned.

The practice of the U.S. Patent Office, it is stated by the *Scientific American*, has been less exacting on this point than the rules prescribe, so that in many cases the reissue specifications have contained substantially new matter; sometimes matter which the patentee might lawfully have inserted and claimed originally, but failed to, through ignorance or oversight, and sometimes matter which had been disallowed by the Office or voluntarily disclaimed by the inventor to secure the issue of his patent. By means of such reissues the inventor's afterthoughts and discoveries have been covered, and too frequently the subsequent inventions of others, or processes and machinery which others may have brought into profitable use, knowing them to be not patented. In this way much injustice has been wrought, and occasion given for many if not most of the more serious complaints against the patent system.

At first, our contemporary says, the courts were inclined to hold that the decision of the Commissioner of Patents in granting the reissue was final and conclusive, and could not be revised. More recently there has been a manifest disposition to go behind the Commissioner's action to inquire whether he may not have exceeded his jurisdiction or improperly performed his duty in granting a reissue for more than was covered by the original patent. Thus in the case of Leggett *et al. vs.* Avery *et al.* (U. S. Supreme Court, October, 1879), it was held that no error had arisen through inadvertence, accident, or mistake, but that the Commissioner had committed manifest error in allowing the reissue for more than was included in the extended patent, and for what was expressly disclaimed therein. In this decision Mr. Justice Bradley remarked that the allowance of claims once formally abandoned by the applicant in order to get his patent through is the occasion of immense frauds upon the public, and is to be discountenanced. In the same connection he said:

"It is doubtful whether a reissue patent can be sustained in any case where it contains claims that have once been formally disclaimed by the patentee, or rejected with his acquiescence in order to obtain his patent. In such case the rejection (omission) of the claim can in no just sense be regarded as matter of inadvertence or mistake, and even if it were such the applicant would seem to be estopped from setting it up on application for a reissue."

In the case of the Giant Powder Company *vs.* the California Vigorite Powder Company *et al.* (U. S. Circuit Court, District of California, October, 1880, Field, J.), the right of the court to review a decision of the Patent Commissioner was clearly stated. In this case a reissued patent was declared invalid because its specification contained an invention of broader scope than the original. The court said:

"As the power to accept a surrender and issue new letters is vested exclusively in the Commissioner of Patents, his decision in the matter is not open to collateral attack in a suit for the infringement of reissued letters. His action, like that of all officers specially designated to perform a particular duty of a judicial character for the Government, is presumed to be correct until impeached by regular proceedings to avail or modify it. He must judge, in the first instance, of the sufficiency of the original specification, whether the same is defective in any particular, whether such defect was the result of an unintentional error, and if so to what extent a new or additional specification should be allowed to describe correctly the invention claimed; and it is to be assumed in every case that he has done his duty. The decisions of the Supreme Court to this effect are numerous, and the doctrine is one of the settled rules of patent law. But it does not preclude the examination of the original and reissued patents, to see whether or not they disclose on their face a case in which the Commissioner had authority to act or whether he has exceeded his authority in issuing letters for an invention different from that described in the original patent."

The Commissioner's authority to reissue being limited strictly to those cases in which the original patent is inoperative or invalid from unintentional error, or where the inventor's claim exceeds his invention, the fact that the patent does not cover all that the patentee could have claimed if his specification had come up to his invention, furnishes no sufficient ground for a reissue.

"The statute authorizing a reissue," the court said, "was intended to protect against accidents and mistakes, and it is only when thus restricted that it can be regarded as a beneficial statute. If the patentee does not embrace by his specifications and claim all that he might have done, and there has been no clear mistake, inadvertence, or accident in their preparation, the presumption of law is that he has abandoned to the use of the public everything outside of them, or at least has postponed any additional claim for further consideration."

The same principle was laid down even more specifically by the United States Supreme Court, in the case of the Swain Turbine and Manufacturing Company, appellant, *vs.* Ladd. This was another instance of expanded claims in a reissued patent. The original specification was as perfect, so far as it went, as the new one, the pretended corrections having been introduced to widen the scope of the patent to give its owners a large and valuable monopoly of an important class of water-wheels. In the Circuit Court of the United States for the District of Massachusetts, the claims of the reissued letters patent had been restricted to the distinct limitation of the invention in the original patent, and that decision was sustained by the Supreme Court. In the opinion of the court, delivered by Mr. Justice Bradley, it was pointed out that "the mistake of the patentee or his assignees seems to have been in supposing that he was entitled to have inserted in a reissued patent all that he might have applied for and had inserted in his original patent. The appellants produced on the argument exhibits tending to show that the patentee before obtaining his original patent had made and done all those things which are embraced in or covered by the reissued patent. If this were true it would be nothing to the purpose. A reissue can only be granted for the same invention which was originally patented. If it were otherwise a door would be opened to the admission of the greatest frauds. Claims and pretensions shown to be unfounded at the time might after the lapse of a few years, after a change of officers in the Patent Office, the death of witnesses, and the dispersion of documents, be set up anew, and the reversal of the first decision obtained without an appeal and without any knowledge of the provious investigation on the subject. New light breaking in upon the patentee as the progress of improvement goes on, and as other inventors enter the field, and his monopoly becomes less and less necessary to the public, might easily generate in his mind an idea that his invention was really more broad and comprehensive than had been set forth in the specification of his patent. It is easy to see how such new light would naturally be reflected in a reissue of the patent, and how unjust it might be to third parties who had kept pace with the march of improvement. Hence there is no safe or just rule but that which confines a reissued patent to the same invention which was described or indicated in the original."

Proceedings of Societies.

ROYAL SOCIETY.

Jan. 6.—The President, followed by General Strachey, V.P. in the chair.—The following papers were read: "Researches into the Minute Structure of the Thyroid Gland," by Mr. E. C. Baber; "Phenomena of the Capillary Electroscope," and Electric Currents caused by Liquid Diffusion and Osmose," by Mr. G. Gore; "Additional Note to a Paper on the Thermal Conductivity of Water," by Mr. J. T. Bottomley; "Note to the Paper on the Structure of the Immature Ovarian Ovum in the Common Fowl and in the Rabbit," by Mr. E. A. Schafer; "Note on a Communication made to the Royal Society by Prof. Roscoe 'On the absence of Potassium in Protagon prepared by Dr. Gamgee,'" by Dr. Thudichum; "Preliminary Note on the existence of Ice and other Bodies in the Solid State at Temperatures far above their ordinary Melting Points," by Dr. Carnelly; and "On the the Effects of Heat on the Chloride, Iodide, and Bromide of Silver," by Mr. G. F. Rodwell.

Jan. 13.—The President in the chair.—The Right Hon. W. E. Gladstone was elected a fellow. The following papers were read:—"On the Forty-eight Co-ordinates of the Cubic Curve in Space" by Mr. W. Spottiswoode; "How do the Colour Blind see the Different Colours?" by Prof. Holmgren; and "Action of an Intermittent Beam of Radiant Heat upon Gaseous Matter," by Dr. Tyndall.

GEOLOGICAL SOCIETY.

Jan. 5.—R. Etheridge Esq, in the chair.—Messrs. G. C. Creik and A. S. Reid were elected Fellows. The following communications were read: "The Archæan Geology of Anglesey," by Mr. C. Gallaway, with a Note on the Microscopic Structure of some of the Rocks, by Prof. T. G. Bonney; "The Limestone of Durness and Assynt," by Mr. C. Gallaway; and "On a Boulder of Hornblende-Pikrite near Pen-y-Cairnisiog, Anglesey," by Prof. T. G. Bonney.

BRITISH ARCHÆOLOGICAL ASSOCIATION.

Jan. 5.—Mr. T. Morgan in the chair.—Mr. G. R. Wright exhibited an early silver denarius with the name of the Eighteenth Legion, found at Cirencester, and detailed the progress of excavations at the Roman villa at Bromham. Mr. Walford rendered some notes on De Lanne's description of London," 1681 and 1690, a scarce book, about to be reprinted. Mr. Lewis produced the fragments of what has been an elegantly worked coffer of ivory of twelfth or thirteenth century date recently found in Telegraph-street. Mr. de Gray Birch described a vase brought from the Egyptian tombs of Gizeh by the Rev. G. Chester, and also a cast of a copper plate for measuring the tonsure of ecclesiastics of St. Paul's Cathedral. It is hollowed and circular, with the figure of a griffin, and appears to have been reduced in size. Mr. Fryer reported some discoveries on the site of St. Aldan's Church at Old Melrose. Mr. Loftus Brock produced a plan and described the remains now being excavated on the site of old Leadenhall Market, Two long walls of the fifteenth century building are visible witth a series of corbels. A Roman pavement of ordinary brick tesseræ has been found over a large part of the surface and covered with the ashes of some great fire. Above this is concrete of a second floor, while below the remains of walls 5 feet thick have been found, indicating a building of importance. These walls have bands of Roman bricks, and one is constructed entirely of that material, pointing to an early period of the Roman occupation. Mr. Grover referred to the constant finding of the traces of a great conflagration in London, which he considered was from the burning of London by Boadicea. The first paper was by Dr. W. Smart, "On Roman Remains found at Nursling, Hants," which was, in the absence of the author was read from the chair. The remains point to the existence here of an important Roman station not yet identified, and its position on a line of road from Bitterne was indicated. A large amount of Samian and black ware has been found. The second paper was by Mr. G. R. Wright, "On the Hardship of the Present Law of Treasure Trove." After referring to the reason of the law in former days, namely, to help the king to assist the revenue, with the punishment of death for evasion, the lecturer passed on to these altered times, when its operation caused either the loss of art treasures by their being broken up by the finders for concealment, or the stoppage of works of research. He instanced the case of the Saxon cemetery at Longbridge, which was in course of excavation by the owner, when certain articles of value found were claimed by the Treasury.

ZOOLOGICAL SOCIETY.

Jan. 4.—Prof. W. H. Fowler, LL.D. President, in the chair.—Mr. Sclater exhibited and made remarks on the skin of the Southern Merganser (*Mergus Australis*) from the Auckland Islands. Prof. A. Newton exhibited, on behalf of Prof. A. Milne-Edwards, an egg of *Cariama cristata*, laid last summer in the Jardin des Plantes, and possibly the first ever seen of which the parentage was certainly known, though an egg, also exhibited by Prof. Newton, had been for many years in the collection of Mr. H. F. Walter. Papers and letters were read: by Dr. A. Gunther, on the zoological collections made by Dr. R. W. Coppinger during the survey of H.M.S. Alert in the Straits of Magellan and on the coast of Patagonia; from Prof. J. O. Westwood on some new exotic species of moths of the genera Castnea and Saturnia, and on two Indian butterflies, *Papilio Castor*, and *P. Pollux*; by Prof. W. H. Flower on the skull of a large elephant seal (*Macrorhinus leoninus*), lately received from the Falkland Islands and on the affinities and systematic position of this animal among the Pinnipeds: Prof. Fowler arrived at the conclusion that the elephant seal is the member of the group the furthest removed from the terrestrial carnivora, and showing most cetacean analogies; he also considered that at present there is no evidence of the existence of more than one species of the genus; by Dr. A. Gunther on the species of Insectivorous Mammals belonging to the genera Rhynchocyon and Petrodromus and on two new species of the former genus, proposed to be called *R. macrurus* (from the Rovunia river) and *R. chrysopygus* (from the Mombaca river.)

SOCIETY OF BIBLICAL ARCHÆOLOGY.

Jan. 11.—Anniversary Meeting. Dr. S. Birch, President in the chair.—The Secretary read his report. The following papers were read: "Notes on a New List of Early Babylonian Kings, being a Continuation of the Paper read December 7th, 1880,'' by Mr. Theo. G. Pinches; "Remarks on the Name Sisku," by Prof Dr. Lauth; and, "Hieroglyyhics attached to the Statue of Cybele near Magnesia-ad-Sipylum" (extract of a letter from Mr. Consul G. Dennis, Smyrna.

ENGLISH SPELLING REFORM ASSOCIATION.

Jan. 11.—Mr. A. J. Ellis in the chair.—Mr. J. B. Rundell read a paper on the manuscript forms of the new letters. Premising that contrary opinions were held as to the introduction of new types. Mr. Rundell shewed that there was no difficulty in reconciling the adverse schools of thought by introducing new letters in manuscript forms, of which he discussed the merits. In the discussion which followed, the Chairman, Prof. Candy, Mr. Fleay, and others, took part.

ASTRONOMICAL SOCIETY.

Jan. 14.—Mr. J. R. Hind, President, in the chair.—Messrs. E. W. Beck, R. L. Bisshoffsheim, A. de Boe, J. Cales, J. Cook, W. E. Cooper, E. Howarth, T. Klein, Commander W. B. Goldsmith, Dr. N. de Konkolv, and the Rev. J. Read were elected Fellows. Mr. Hind read a paper by Prof. Celoria on the bearing of ancient eclipses, and especially that of Agathocles, on the moon's motion. Mr. Stone read a paper on "Some Difficulties connected with the Determination of the Diameter of Mars." Having examined the observations made at Greenwich, and taking into account the personal equation of the various observers, he came to the conclusion that two different sets of measures of the diameter of the planet had been made, which do not correspond with one another. The sets of measures giving the smaller diameter of the planet seem to have been made when Mars has been comparatively near to the earth, and the other set of measures (which he thought must have included the atmosphere of the planet) when Mars has been at a greater distance from the earth. Mr. Ranyard read a paper on the nebula in Orion, a photograph of which has recently been taken by Dr. H. Draper, of New York The photograph was taken on the 30th September, and showed the brighter nucleus of the nebula and stars down to the ninth and a half magnitude. It was the first instance in which any trace of a nebula had been obtained upon a photographic plate. Mr. Ranyard pointed out that the brightness of the various regions of the nebula did not correspond with the relative brightness of similar regions as shown in the drawings of the nebula made by Bond, Herschel, Liaponnov, Lassell, Secchi, or the Earl of Rosse. The drawings differ greatly from one another, and when compared in order of date there does not appear to be any reason to suppose that the differences correspond to changes in the nebula. A discussion ensued, in which Messrs. Common, De la Rue, Stone, and R. Capron took part, as to the trustworthiness of photographs taken with different instruments and under different conditions for determining change in the object photographed. Prof. Pritchard read a paper on Dr. Hartwig's recent determination of the lunar physical libration, which corresponded with the results obtained from the measurement of photographs taken at the Physical Observatory, Oxford. Several short papers were read on observations of the partial solar eclipse of December 31st, 1880. Mr. Christie read a paper by the Astronomer-Royal, on a series of new spectroscpic measures of the motion of stars in the line of sight which had been made during the past year at the Royal Observatory, Greenwich. Mr. Marth read a paper "On the apparent Conjunctions of the Satellites of Uranus during the year 8888." March of this year is the centenary of the discovery of the planet, and Mr. Marth suggested that the centenary should be celebrated by devoting special attention to determining the positions of the satellites, which could now be observed with superior instrumental means to those at the disposal of Herschel.

SOCIETY OF ANTIQUARIES.

Jan. 13.—H. Reeve, Esq., V.P., in the chair.—This being an evening appointed for the ballot, no papers were read. The following Fellows were declared to be elected: Sir C. E. Trevelyan, Bart.; Revs. W. W. Harvey and J. W. Ebsworth; Messrs. W. H. Richardson, T. K. Hall, D. R. Thomas, R. A. D. Lithgow, J. Simpson, J. S. Dyce, S. Clarke, A. G. Hutt, J. Tolhurst, R. W. Cochran Patrick, M.P., and W. B. Richmond (Slade Professor of Oxford). The two last-named gentlemen were proposed by the Council, *propter merita*, under Statutes, chap i. § 3.

INSTITUTION OF CIVIL ENGINEERS.

JAN. 11.—Mr. Abernethy delivered his inaugural address as President.—It was announced that the Council had recently transferred Messrs. C. S. Allott, E. K. Burstal, J. M. Dobson, F. Garrett, A, J. Hamilton-Smythe, T. Hewson, and E. E. Sawyer to the class of Members, and had admitted thirty-three gentlemen as Students. Mr. E. G. Sheward was elected a Member; Messrs. G. N. Abernethy, D. F. Goddard, J. H. Hanson, G. E. Jarvis, R. A. MacBrair, A. de Saubergue, E. P. Seaton, G. H. Stephens, and C. F. Wike Associate Members; and Mr. F. E. Baines an Associate.

JAN. 18—Mr. J. Abernethy, President, in the chair.—The paper read was "On Deep Winning of Coal in South Wales," by Messrs. T. F. Brown and G. F. Adams.

MATHEMATICAL SOCIETY.

JAN. 13.—S. Roberts, Esq., President, in the chair.—Miss C. A. Scott and Messrs. J. P. Smith, O. H. Mitchell, and T. Craig were elected Members.—Dr. Hirst gave a rapid sketch of the career and work of the late M. Chasles, and in very feeling terms dwelt briefly upon his private relations with the great geometer, who had been his tutor and friend.—The following papers were communicated: "On an Apparently Paradoxical Relation of the Circle, Parabola, and Hyperbola," by Mr. A. J. Ellis.—"A Proof of the Differential Equation which is satisfied by the Hypergeometric Series," by the Rev. T. R. Terry.—"On the Periodicity of Hyperelliptic Integrals of the First Class," by Mr. W. R. W. Roberts,—"On the Tangents drawn from a Point to a Nodal Cubic," by Mr. R. A. Roberts.—"Sur une Propriété du Parametre de la Transformée Canonique des Formes Cubiques Ternaires," by Signor Brioschi (Milan).—"Note on a Kinematical Theorem connected with the Rectilinear Courses of two Vessels sailing Uniformly," by Mr. C. W. Merifield.—and "A Partition-Problem connecting the Angles of a Triangle with the Angles of the Successive Pedal Triangles," by Mr. J. W. L. Glaisher.

INSTITUTION OF CIVIL ENGINEERS.

AT the meeting on Tuesday, the 1st of February, Mr. James Abernethy, F.R.S.E., President, in the chair, it was announced that the Council had recently admitted Messrs. Baldwin Harry Bent; Edward Robert Birch, B.A.; Selwyn Alfred Cutler; Henry Joseph Hamp; Hugh Rowland Jackson; Thomas Cassinet Palmer; Allan Booth Rome; Walter Douglas Seaton; and Archibald William Willett; as Students. The monthly ballot resulted in the election of Messrs. John George Barton, West Donegal Railway; Francis Collingwood, Resident Engineer, New York Approach, Brooklyn Bridge; Josiah Easton Cornish, Resident Engineer and Manager, Alexandria Waterworks; Casimir Stanislaus Gzowski, Toronto, Canada; Robert Searles Lindley, Frankfort-on-the-Maine; Charles Sandiford, Loco. Supt., Scinde, Punjâb, and Delhi Railway, and Richard Flint Welby, Rio de Janeiro; as Members;—of Messrs. James Thomas Arrow, Westminster; John Audley Frederick Aspinall, Great Southern and Western Railway, Dublin; John Barker, Resident Engineer, Sao Paulo Railway, Brazil; Edward Golding Barton, Dundalk; Arthur Irvine Beaufort Bedford, Assistant Resident Engineer, Port Trust, Bombay; Thomas Blair, Stud Inst. C.E., St. Mary Axe; John Holmes Blakesley, M.A., Earl's Court; Charles John Ennor, Wadebridge; Charles Farquhar Findlay, M.A., Dockyard, Liverpool; George Frederick Lee Giles, Kimberley, South Africa; Malcolm Grant-Dalton, Stud. Inst. C.E., Westminster; Charles Frederick Hughes-Hallett, M.A., Westminster; William Inglis, Stud. Inst. C.E., North British Railway, Montrose; George Arthur Jones, Stud. Inst., C.E., Westminster; Jorgen Daniel Larsen, Poultry; John Lineacre, Assistant Engineer, Brecon and Merthyr Railway; Henry Hare Mainwaring, Stud. Inst. C.E., Assistant Engineer, South Metropotitan Gas Company; Walter Sery Nicholson, Westminster; John Perry, West Kensington; Richard Read, City Surveyor, Gloucester; Edward Brough Taylor, Stud. Inst. C.E., Westminster; Charles Henry Thomas, Chief Resident Engineer, Brecon and Merthyr Tydfil Junction Railway; Alfred Edward White, Town Hall, Hull; John Henry Williams, Stud. Inst. C.E. Westminster; and John Edward Worth, Borough Engineer, Burslem; as Associate Members;—and of Messrs. William Robert Bousfield, M.A, Barrister-at-Law, Temple; and Richard Boughey Monk Lingard-Monk, Solicitor, Manchester: as Associates.

THE TURNERS' COMPANY. — A banquet was recently given at the Freemasons' Tavern, by the Worshipful Company of Turners to about 200 guests. The Master, Mr. D. W. Greenhough, presided, and was supported by the Lord Mayor, the Right Rev. Bishop Claughton, Archdeacon of London, Sir Lewis Pelly, K.C.B., Mr. Alderman and Sheriff Fowler, M.P., Mr. Sheriff Water low, the President of the Royal Academy, the Master of the Drapers' Company, the Prime Warden of the Fishmongers' Company, the Prime Warden of the Goldsmiths' Company, the Master of the Skinners' Company, the Master of the Ironmongers' Company, the Master of the Cutlers' Company, the Master of the Shipwrights' Company, and other representatives of civic companies and persons of distinction. Sir Bartle Frere, an expected guest, was unable to be present. The loyal toasts, proposed by the Master, received a cordial response. Mr. Gregory, C.M.G., Past Master, proposed "The Army, Navy, and Reserve Forces," acknowledgment being made by Sir Lewis Pelly, K.C.B., and Colonel Allan. The Master having given "The Lord Mayor and Corporation of the City of London," the Lord Mayor in reply expressed his gratification that such cordial feeling existed between the city companies and the corporation, and if their rights and liberties were assailed he believed there would be a display of strong and united action in their defence. Responding to the toast of "The Sheriffs," proposed by Mr. John Jones, Past Master, Mr. Alderman and Sheriff Fowler, M.P., after expressing his regret at the absence of Sir Bartle Frere, reminded those present that they were members of a vast imperial community extending over every part of the globe, and warned them not to forget the duty they owed to their fellow citizens. To the toast of "The Turners' Company," proposed by the Lord Mayor, the Master replied, and adverted to the good service which had been done by the company in promoting technical education, especially in connection with diamond polishing. Bishop P. Claughton proposed "Science and Art," the President of the Institution of Civil Engineers responding for science, and the President of the Royal Academy for art. There were also other toasts.

M. JAMIN, having obtained on the 3rd of January the absolute majority of suffrages of the Administrative Commission of the Académie des Sciences, was proclaimed Vice-President for the year 1881. MM. Decaisne and Edmund Becquerel were at the same meeting elected members of the Administrative Commission.

DEEP WINNING OF COAL IN SOUTH WALES.

By Messrs. THOMAS FORSTER BROWN and GEORGE FREDERICK ADAMS, MM. Inst. C.E.

AT the meeting of the Institution of Civil Engineers, on Tuesday, the 18th of January, Mr. James Abernethy, F.R.S.E., President, in the chair, a paper was read on the above subject. The authors, who were professionally associated with Harris's Navigation Pits, the deepest winning in the district, described the operations as a fair example of the details connected with winning deep coals in South Wales.

The depth of the lowest seam at present sunk to was 760 yards; the pits were each 17 feet in diameter inside the walling. In addition to the depth, a special feature was the thickness of the hard and heavily-watered rock penetrated. Guide ropes, upon the Galloway principle, were used in sinking, and the value of this principle was shown in the saving of over two minutes in steadying the bowk at the bottom of the pit at depths of 475 and 530 yards, the total time occupied in clearance at the latter depth being three minutes twenty-six seconds.

The method of dealing with the various feeders of water during sinking were described: one of the pits was drained by a hole bored by the diamond machine, which was put down at a depth of 175 yards from the surface, for a farther depth of 860 feet. Where the strata were conformable, and cut up by faults which intersected all the measures, considerable objection existed to metal tubing, even for comparatively shallow depths, for the water could rarely be prevented from forcing its way through fissures into the underlying strata. Moreover, provision had to be made for the probable working of the Brithdir seam, a very watery measure, lying at a depth of 250 yards. On account of these and other circumstances it was ultimately decided to provide for the permanent pumping of all the feeders, and a powerful 100-inch Cornish pumping engine was erected. The parallel motion for the main pump-rods was obtained by a gudgeon attached to the top of two rods carrying two slide-blocks, which worked in cast-iron guides 18 feet long, and 27 inches wide. This gudgeon was attached to the beam by two hammered iron radius-rods 43 feet long, 10 inches wide, and tapering from 3 inches thick at the top and bottom, to $1\frac{1}{2}$ inch at the middle. The space between the rods was filled with pitch pine, 12 inches thick at the top and bottom, and 18 inches wide in the middle. Five lifts, three of which were 26 inches in diameter, and the others 22 inches and $21\frac{1}{2}$ inches, were worked by the Cornish engine. The total feeders amounted to 440 gallons, of which 298 were pumped from a depth of 467 yards. The rods were double, of pitch pine 16 inches square. To economise space in the pit, the lifts were fixed in one perpendicular line; to effect this, the rods directly above the plunger and the rods below were connected by side-rods and distance pieces; the horizontal connecting rod of the H piece being cast semicircular to allow the rods to pass down in a straight line. The total weight of rods, &c., amounted to $181\frac{1}{2}$ tons, that of the water being 133 tons: 35 tons of the difference were counterbalanced by a balance beam in the pit, leaving $13\frac{1}{2}$ tons to overcome friction.

A large diamond boring machine was used for a portion of the sinking. The apparatus weighed 10 tons, and consisted of four beams or transoms, fixed to a centre-piece; on the transoms were placed the drills (ten in number, which could be moved to any part of, or inclined to any angle parallel with, the face of the transoms, and each drill could be started or stopped singly. In making the first trials, thirty to forty short holes, at varying angles, and from 3 to 5 feet depth, were bored, the operation requiring twelve to fourteen hours. Nearly one half of this time was occupied in jacking the machine for the various positions required to bore the sumping holes, bench holes to sump, and, finally, the cropping holes. Long holes, from 15 to 30 feet in depth, were subsequently tried, and blasted in sections; but having to be bored vertically, so as not to pass out of the line of the shaft, they had not always the most effectual lifting power. Better progress was made with single drills, but the cost of the diamonds became too great for the frequent holes and changes, and the contracting company completed their contract by means of a percussive drill, designed by Colonel Beaumont. "Ingersoll" drills were afterwards used; these had a diameter of $3\frac{1}{4}$ inches, and a stroke of $4\frac{1}{2}$ inches, and gave excellent results; the only difficulty experienced being in the wear and tear of the tappets, which when they broke, generally caused damage in the cylinder.

In hard and wet rock dynamite was found to be a much more effective explosive than gunpowder, requiring about half the number of holes, and saving tamping. In shale, without water, powder was more effective, dynamite being more rapid in its action. In sinking through 3 yards of dry Pennant rock, the cost of powder and dynamite were respectively £12 1s. 3d., and £10 1s. 8d.

Under the circumstances which attended this sinking in hard and wet rocks, 3 yards were considered good progress by hand, and $4\frac{1}{2}$ by machine per week; but the authors were of opinion that this rate ought to be improved upon with further experience; they had also arrived at the conclusion that the cost of sinking by machine was less than by hand labour. The average rate of sinking, including walling, but exclusive of stoppages, was 3·77 yards per week, there being nearly an equal percentage of hard rock and shale; the actual sinking occupied about one-half the total time, and walling 12 per cent. The south pit, which was the deeper of the two, was commenced in February, 1873, and finished in February, 1879. The average cost per yard of sinking in shale by hand and without pumps near the bottom of the shaft, was £11 19s. 6·8d.; with pumps, £13 2s. 8·9d.; in hard Pennant rock by hand without pumps, it was £40 8s. 5·4d.; with pumps, £44 13s. 2·9d. In Pennant rock, with pumps and three drills, the cost was £34 3s. The cost of the 18-inch walling without pumps, including the proportion of iron curbs, came to £11 7s. 10d. per yard in depth, or £1 3s. 10d. per cubic yard; with pumps, to £1 7s. 5d. per cubic yard. These averages included all labour, stores, coal, the items of which were given in a tabulated form.

The authors alluded to a furnace as being, probably, the most effective means of ventilation at such a depth; but leaving this question for future consideration, they had meantime erected a Schiele fan 14 feet 3 inches in diameter, and capable of producing a current of about 250,000 cubic feet per minute; this had been done after a series of experiments in various districts. The authors stated their objections to the positive type ventilators, viz.: that in the event of obstruction occurring in the air ways, undue pressure might be applied to separation-doors, air-crossings, &c.; besides which, they caused a vibratory motion, were costly to erect, and the working parts were liable to get out of repair. Of the closed fans—which it was stated gave slightly better results than open fans—the Guibal and Schiele were the best.

The winding engine was designed to raise 2,000 tons of coal in ten hours of constant drawing; the weight, exclusive of the rope being $10\frac{1}{2}$ tons, and the velocity of the ascending cage 40 to 45 feet per second. The scroll drum, with a smaller diameter of 18 feet, rising by fourteen coils to 32 feet, was considered the best method of counterbalancing the rope. The cylinders were 54 inches in diameter with 7-feet stroke; they were inverted and placed on cast-iron supports, the drum being fixed below on masonry pillars. The valves were double beat, and for the steam-valves, Barclay's simple trip expansion gear was used. The rope was a parallel flat rope of the best selected steel, and consisted of 114 No. 11 guage wires. The calculated breaking strain was 104 tons, and the factor of safety was 9.

The pit frame, which was entirely of wrought iron, sheaves, cages, trams, and guides in the pit, were fully described; also, a scheme for loading and unloading a single decked cage by gravitation of tubs; the empty trams were hoisted about 6 feet, and made to run down an inclined way to the cage, being stopped and relieved by a system of catches. The cage was so arranged that on landing on the steps the bottom was inclined.

The shaft pillar was 400 yards square, and the laying out of roads and method of working trams about the pit bottom were fully explained.

PORTSMOUTH DOCKYARD EXTENSION WORKS.

By Mr. Charles Colson, Assoc. M. Inst. C.E.

In this paper, recently read before the Institution of Civil Engineers, it was observed that the great changes during the last few years in the science and practice of Naval Architecture had rendered necessary additional accommodation, adapted to the requirements of the modern class of ships, at the principal naval ports of the kingdom, particularly at Chatham and at Portsmouth. In 1540, the Royal Dockyard at Portsmouth covered only 8 acres; by gradual additions it had increased in 1790 to 95 acres, at which it remained until steam began to be the motive agent. In 1843 the present steam basin and four large docks, covering an area of 20 acres, were commenced, and were completed in 1848. When the iron-clads of the modern navy came into being, docks and basins with special features were required, and in the session of 1864 Parliamentary powers were obtained for the construction of new basins and docks. These works were on the north side of the islaud of Portsea, somewhat to the east of the old Dockyard. The area enclosed was about 180 acres, of which 95 acres had been reclaimed from the mud lands of the harbour. These works were designed by Colonel Sir A. Clarke, K.C.M.G., C.B., R.E., Assoc. Inst. C.E., and were carried out under the superintendence of Mr. H. Wood, M. Inst C.E., Mr. J. Macdonnell, and the author.

The geological formation exposed during the execution of the works was the lower tertiary or eocene series; on the south side the London clay was from 10 to 40 feet thick, and cropped out a short distance from the shore line; above was a recent deposit of sand and gravel. The bed of the harbour had at some remote period been denuded of London clay, the surface being covered with mud varying from 2 feet thick on the south side to 35 and 40 feet on the north side. Beneath the mud were the beds subordinate to the London clay of a dark greenish sand, containing masses of hard shell rock.

Beford the works could be commenced it was necessary to enclose the site. This was done by constructing a shallow dam on the highest part of the mud and an outer dam enclosing the harbour wall. The inner dam was completed in October, 1868, and 1,200 feet of the outer dam were closed at the same time. The additional water area or basin accommodation consisted of the tidal basin, 9 acres in area, with a depth of 43 feet 6 inches at H.W.O.S.T., and 30 feet at L.W.O.S.T., and about 1,600 feet of wharfage; the repairing basin, having an area of 21 acres, and 34 feet 10 inches in depth at H.W.O.S.T., and 21 feet 4 inches at L.W.O.S.T.; the rigging and fitting basins, each having an area of $15\frac{1}{2}$ acres. with 34 feet 10 inches depth of water at H.W.O.S.T. and 21 feet 4 inches at L.W.O.S.T.; the wharfage accommodation in the three latter basins was equal to about 8,200 feet. The whole of the works were constructed in Portland cement, more than 100,000 tons having been used.

The retaining walls for the basin and harfour wharves varied in sectional area, according to the pssition and depth from the level of the coping. The tidal basin wall was 48 feet 10 inches in height, and the width at the base was 22 feet 6 inches, diminishing to 6 feet at the top. The harbour wall was 44 feet 6 inches high by 20 feet wide at the base, and the basin walls were 38 feet 6 inches high and 16 feet wide at the base. The materials used were brick and concrete, with Portland stone facing at the top, and granite coping. The foundations were laid upon piles ordinarily spaced 5 feet and 4 feet apart from centre to centre. The size of the piles varied from 11 inches to 15 inches in diameter, and their length from 14 feet to 19 feet for beech, and 20 to 30 feet for fir; transverse and longitudinal sleepers were fitted over the pile heads; on the outside was a continuous row of sheet piling. The pile shoes were of a composite character, the plug being of cast iron, with wrought iron straps; all the piles, with the exception of the back row, were driven to the same batter as the wall, viz., 1 in 8. The toes of the walls were protected by a concrete foreshore about 10 feet wide.

The docks contemplated were five in number; of these only three had been constructed, viz., two communicating with the repairing basin and the deep dock, which was entered from the tidal basin. The entrances only of the two others had been constructed, the docks being left for future consideration. The foundation of one of the docks on the south side of the repairing basin was partly on the London clay and partly on the sandy beds below, and was constructed of beech piles from 14 to 16 feet in length, spaced generally 5 by 4 feet apart, except near the head, where the lines of piles were altered to suit the curve. Considerable difficulty was at times experienced in driving these piles, in consequence of meeting with isolated beds of stone. When these stones were near the excavation level they were removed and the pile was driven in its proper position and the hole filled with cement. The foundations for the broad altar and all works above were also on piles, but at a higher level than the foundation for the floors and lower altars. The spaces between the sleepers on the top of the piles, and to a depth of 2 feet 6 inches from the top, were filled with Portland cement concrete. The floor was constructed of Portland stone and granite, and was 7 feet 6 inches thick. The length from within the entrance to the broad altar at the head was 410 feet; the width between the copings was 110 feet, and mean depth 42 feet. The entrance to this dock was constructed for an ordinary ship caisson; the width between the copings was 80 feet, and the depth of water at H.W.O.S.T., 38 feet 6 inches. The other dock was parallel with the one just described; the width of the wharf between the two being 100 feet. The foundation of this dock was somewhat different, as the piling at a higher level for the broad altar was omitted and the excavation was continued to the same level as the foundation of the floor of the dock. The length of the floor from the inside of the entrance to the broad altar at the head was 406 feet 6 inches, and the mean depth 42 feet 3 inches. The entrance was constructed for a ship caisson, and was 82 feet wide at the level of the coping; the depth of water at H.W.O.S.T. was 33 feet 10 inches. The culverts for filling and emptying both these docks were arranged on each side of the entrance. The two docks yet to be constructed would also be on the south side of the repairing basin. The piling in the foundations of the entrances had been omitted, the sheet piles only being retained. The deep dock on the east side of the tidal basin was so designed that ships could enter at low water of spring tides. In the foundations, the ground having proved more satisfactory than had been anticipated, the piles were omitted, and an extra depth of concrete substituted. The total length of the floor of this dock from the inner face of the entrance to the back of the recess at the head was 415 feet, and the mean depth 46 feet 8 inches. The culvert for emptying this dock was 7 feet in diameter. The entrance was 82 feet wide at the level of the coping, and the depth of water at high and low water of spring tides 41 feet 6 inches and 28 feet respectively.

The north and south locks were abreast to the north of the deep dock, and formed with the tidal basin the grand entrance to the system of docks and basins constituting the extension of the dockyard. The length of the floor inside the entrances was 438 feet, and the width at the level of the coping 100 feet. The west entrance of the deep dock and lock was closed by a sliding caisson, which could be hauled into a camber by engines and gear placed in chambers beneath the roadways. The depth of water over the sills of these entrances was such that ships could enter at low water. The east entrance was closed by a ship caisson and had the same depth of water as the other docks.

All the docks and basins were drained by a 7-feet culvert communicating with the two main pump wells. These were situated at the south-west corner of the repairing basin, and were 55 feet 5 inches deep below the level of the coping. All the sluices were of cast iron faced with gun-metal, and the arrangement of the machinery was such that the valves could be raised either by hand, or by shafts and gearing in connection with the capstan or caisson engines. Each penstock was provided with an arrangement for throwing the clutch out of gear by the action of the valve, when it was either completely raised or lowered. The whole of the penstocks, capstans, and sliding caissons were worked by compressed air. The main pumps were on the plunger principle, with plungers 6 feet in diameter, and of 6-feet stroke, constructed by Messrs. James Watt & Co., of Birmingham. In the smaller drainage chamber of the well there were three single-acting pumps, each 16 inches in diameter, and having a stroke of 2 feet 6 inches. The engines for working these small drainage pumps were of the ordinary type, having two inverted cylinders, 16 inches in diameter, and 2-feet length of stroke. The main pumping engines were of the compound type with two inverted cylinders, the high pressure being 40 inches and the low pressure 64 inches in diameter. These pumps were capable of clearing two of the largest docks, containing together about 90,000 tons of water, in about four hours.

THE UTILISING OF THE TIDES.—A Philadelphia engineer has invented, it is claimed, a machine by which the power of the tides can be utilised. Numerous plans have been proposed for the accomplishment of this most desirable end, but only under exceptional conditions have they been practical or economical. If the new device can harness the tide in the open channel, so as to convert any considerable portion of the vast power into working force, the inventor will rank among the great benefactors of humanity. Emerson says somewhere, "Hitch your waggon to a star;" a device for utilising the free tides as they sweep along our shores, would come next to that, since it would enable us, through converters and carriers of electricity, to hitch our waggons to the sun and moon.

RECENT AMERICAN AND FOREIGN INVENTIONS.

Tenons of wagon and carriage wheels and also tenons of bars composing or forming part of the *framework of wagon bodies*, has been patented by Mr. Andrew P. Almquist, of New Windsor. Ill. It consists, essentially of a wooden block having a cutter pivoted thereto for trimming the spoke tenons and suitable gauges for supporting the spokes while being trimmed.

An improvement in power looms has been patented by Mr. P. Dorgeval, of Paterson, N.J. The invention consists in a lay or batten constructed in two portions, one portion consisting of the shuttle rail supported on arms that are vibrated by power, the other portion consisting of the reed carried by side arms hung on a shaft, which arms are moved to beat up by a weight. The reed frame is behind the shuttle rail, so that the backward movement of the reed is given by contact of the shuttle rail; also in a cam and link connection of peculiar construction for vibrating the batten and resting the same to give time for the passage of the shuttle. Fingers are pivoted on the shuttle rail and connected with slide blocks in the shuttle boxes, for movement by the shuttle to raise and hold the weft thread taut during the movement of the batten.

Mr. Joseph Curson, of Lyons, France, has patented an improved machine for *shaving wool or hair from hides*, which is provided with an endless knife passing over two pulleys and through suitable guides, to the cutting edge of which the hide is fed by a series of reciprocating and oscillating claws, and is pressed down upon the cutting edge by a roller.

An *improved bark mill* has been patented by Mr. Dennis O'Brien, of Oswayo, Pa. The invention consists in combining a radially-slotted stationary plate provided with grinding teeth on one edge of each slot with a wheel having teeth on the under side.

Mr. T. Naish, of Birmingham, has patented an improved variable feed for *rock and other drills*. The inventor employs two friction disks, connected respectively with a shaft and the drill, which are arranged at right angles to each other, the edge of one disk working in frictional contact with the edge of the other, but made adjustable along its shaft to vary its distance from the drill, so as to vary the rapidity of motion of the driven wheel.

Messrs. Arthur L. Bigsby and Charles L. Bigsby, of Trenton, Mo.. have patented an improvement in positive *motion looms*, in which the shuttle is operated upon and moved continuously during its entire passage across the fabric being woven. The object of these improvements is to construct a loom in which two or more shuttles or colours may be used, and such shuttles shifted at each opening of the shed or longer intervals, as may suit the pattern being woven, and to furnish a more easy and positive motion to the shuttle, accelerating and diminishing its speed without any sudden start or stop.

An improved *post-hole borer*, patented by Mr. Henry Landin, of Forest, O., which consists in a yoke having toes, in combination with a divided nut and slotted bench and gearing. The operator sits on the bench and operates the borer by turning the cranks.

Mr. James S. Schoonover, of Titusville, Pa., has patented a *compound crank*, consisting of several cranks or eccentrics arranged spirally at equal distances apart upon a central shaft so as to form a complete spiral.

Mr. Carl Posen, of Offenbach-on-the-Main, Germany, has patented an improved fastening for *pocket-books* and other articles, which is so constructed that they may be easily and conveniently fastened and unfastened, and it presents a neat and finished appearance.

An *improved drop gate* has been patented by Mr. James Beezley, of Rocky Ford, Col. The object of this invention is to furnish drop gates so constructed that they may be conveniently opened and closed by persons riding in a carriage or on horseback.

Securing wheels to axles has been patented by Mr. Thomas H. Outerbridge, of Hamilton, Bermuda, the object of the invention being to dispose with the screws and nuts generally used for that purpose, and to furnish a lock that shall secure the hub safely to the spindle and can be readily manipulated.

The sheets of *gaff-topsails* on vessels are led through sheaves at the outer end of the mainsail gaffs, and it frequently occurs that the sheets part or unbend from the sail and unreeve from the gaff, so that a man must be sent out on the gaff to reeve the sheet or the gaff and mainsail lowered to the deck for the same purpose. To lower the gaff, especially if the wind is fresh, involves considerable wear and tear on the sails and rigging, besides loss of time and labour, while the work of passing out on the gaff to reeve the sheet is the most hazardous undertaking required on vessels, as there is no foot-ropes, beckets, or other conveniences to insure safety, and loss of life by men being thrown from the gaff is of frequent occurrence. Mr. Frank B. Court, of Holyoke, Mass., has patented means for reeving gaff-topsail sheets, rendering such work safe and rapid. The invention consists in the combination with the gaff of an endless rope fitted to run in the throat and end sheaves of the gaff, so that the top-sail sheet can be rove from the deck or from the throat of the gaff.

Mr. Green Smith, of Coal Valley, West Virginia, has patented improvements in that class of *windows* designed to secure the benefits of ventilation through the entire area of the window, to permit the window-panes to be washed on both sides without taking out the sash or going outside of the window, and to secure the balancing of the sashes, the independent movement of either sash, or the entire removal of the sashes, as may be desired.

An improved *fan*, patented by Mr. Max Rubin, of New York city, relates to that class of fans on which the wing or web folds between two handles and opens into circular form when in use, and has for its object to make the fans more convenient in use and less liable to get out of order than fans constructed in the usual manner.

An improvement in steel earth *scrapers* has been patented by Mr. William Haslup, of Sidney, O. It consists in the means for fastening the handles to the sides of the scraper, and in curved and flanged socket plates arranged on the inner walls of the scraper to receive the ends of the backboard.

A machine for fitting and putting together the several parts of a *waggon wheel* has been patented by Mr. William Casady, of Milton, Iowa. The invention consists of felly-boring, spoke-tenoning, and spoke gauging devices combined in one machine,

Mr. George E. Bales, of Walla Walla, Washington Ter., has patented an improved *snap-hook and buckle* for breast-straps, hitching, and other straps or lines on which snap-hooks are commonly used. This snap hook is more easily unsnapped and less liable to become clogged with ice or mud than those now in use.

An improved bale tie has been patented by Mr. Thomas B. Taylor, of Mount Meigs, Ala. The object of this invention is to apply *bale ties and hands* in such manner that the bands will not turn upon the bales when being tightened, and will be securely held, retaining the compression by preventing the bale from swelling when the pressure is withdrawn.

Messrs. T. A. Trudelle and Eusebe Maheux, of Quebec, Canada, have patented an improved *car coupling*, which consists of a spring-actuated draw head and peculiarly adjusted levers operating a coupling pin, in combination with a spring-actuated draw bar, that serves to hold the coupling pin up when the cars are uncoupled.

Mr. Benjamin F. Walker, of Derrick City, Pa., has patented an improved *clasp-packer* for *well-tubing joints* to prevent the waste of oil when removing tubing from oil wells. The device is made in two semi-cylindical parts, hinged to each other at one side edge and fastened at the other side edges with a hook and pin, and provided with packing at its ends and side edges to adapt it to be clasped around the tubing at its joint, and having a side opening and hose to carry the oil to a receiver.

An improved *engineer's level-rod* has been patented by Mr, Michael L. Lynch, of Cameron, Texas. This invention relates to the class known as "self-reading level rods," and is distinguished from others by the peculiar manner of marking the scales upon the face of the rod, whereby the readings of fractions of a foot may be readily made without the use of a sliding target.

Mr. William J. French, of Carencro, La., has patented an improved device for securing nuts on railroad, bridge, and other bolts. The invention consists of a recessed segmental washer, in combination with a segmental forked or pronged clip locking in with said washer.

Mr. Abram H. Smith, of Wauseon, O., has patented an improved *hay elevator*, so constructed that it may be easily operated, and will not allow the loaded fork to settle down or sag while being carried from the barn floor to the mow.

Mr. John L. Volkel, of Sulphur Springs, Mo., has patented an improvement in *breech-loading firearms* adapted for rapid firing. The inventor dispenses with a separate device for extracting the shells, and uses a swinging lever carrying the breech block, that is formed to receive the cartridge and retain it while being fired. The cartridge is thrown out by the act of opening the breech.

A *churning apparatus*, so constructed as to give a very rapid motion to the dasher by a slow movement of the driving power, has been patented by Mr. Charles B. Davidson, of St. Joseph, Mo.

Mr. Lewis A. Fish, of Faribault, Minn., has patented a simple and convenient device especially adapted for use in flouring mills and feed stores and granaries for holding bags open for filling and conveying them, open or closed, from one place to another.

A *plough* so constructed that the share or point will have a rocking movement while drawn through the ground, to cause it to more thoroughly loosen the soil, has been patented by Mr. Henry F. Edey, of Bridgetown, Island of Barbadoes.

An improved adjustable *wrist-pin*, which is simple, convenient, and effective. and prevents noise and irregular motion, has been patented by Mr. Lafayette Thomas, of Marshall, Mo. The invention consists in a wrist-pin formed of a cylinder attached to the pitman and fitting into the cap-shaped head of a pin that passes longitudinally through the cylinder, the pin being held in the desired position by a screw nut provided with teeth in which a sliding spring catch takes and prevents the nut from rotating.

Mr. George H. Williams, of Fort Smith, Ark., has patented a machine for making *bricks*, so constructed as to mould the bricks, press them, and deliver the pressed bricks upon off-bearing belts automatically. It is simple in construction and rapid in operation.

A shank support and protector for boots and shoes has been patented by Messrs. Edson P. Hadley, of Shelburne Falls, and Thomas Joyce, of Buckland, Mass. The object of this invention is to prevent the boot or shoe from ripping at the shank, and by protecting the shank to prevent it from being cut or worn by shovelling, spading, or any pedal labour, or from being burned when the wearer rests his foot on the cope of the grate or stove for warming.

Messrs. Charlton Patterson and Herman L. Abrahams, of Russell, Kans., have patented a *sulky plough* in which the adjustable axles can be raised and lowered to regulate the depth at which the plough works in the ground without throwing the wheels out of line, and without affecting the set and gather of the axles.

An improved machine for *covering telegraph cables and wires* with insulating material and with a leaden protecting envelope has been patented by Edouard E. Berthoud, of Cortaillod, and Arnold F. Borel, of Boudry, Neuchatel, Switzerland.

An *ellipsograph*, so constructed that it may be adjusted to describe ovals of different sizes with parallel curves without disturbing the guide pivots, and to cut ovals with their edges straight or bevelled in either direction, as desired, has been patented by Mr. Edward L. Gaylord, of Bridgeport, Conn.

An improved *ash sifter*, which is simple in construction, and which operates without permitting the dust of the ashes to spread as with the ordinary ash sieve, has been patented by Messrs. Augustus F. Morse and George F. McIntosh, of Hallowell, Me. The invention consists in a box provided with a hinged sieve lid provided with a spring bar for holding the ash pan in the box when the lid is closed. The box is provided with a shaft mounted in a larger box provided with a suitable lid, and with an opening in the bottom through which the ashes can drop into a barrel or other receptacle upon which the large box is placed.

An improved *ironing machine* has been patented by Mr. John Vandercar, of West Troy, N.Y. This machine is designed especially for use in laundries for smoothing and drying collars, cuffs, and other articles. It is so constructed that the articles to be operated upon will be fed automatically into and through the machines.

A *circulating device for steam generators* has been patented by Mr. Dan. Abell, of Carson City, Nev. This invention consists in combining with the feed water and circulation pides of a steam generator a steam pump for keeping up a continuous and rapid circulation of the water within the space of the generator.

An *improved propeller* has been patented by Mr. Rio Gardner, of Westerly, R. I. The invention consists of a hub having short arms, and of blades united thereto by mortise and tenon joints and suitable bolts and screws.

An *improved locomotive spark extinguisher* has been patented by Messrs. G. A. Gunther of Bath, and W. Kowalski of Brooklyn, N.Y. The object of this invention is to deaden or extinguish sparks passing out through the smoke stack of a locomotive. The construction of this device is peculiar, and cannot be readily described without engravings.

Messrs. William G. Wilson and George S. Darling, of Chicago, Ill., have patented *improvements in shuttle races* for sewing machines. These improvements relate to circular race-ways for oscillating shuttles, and are designed to guide and steady the shuttle as it starts forward and insure its entering the loop of thread.

Mr. Jacob R. Scott, of Nyack, N.Y., has patented an *improved machine for sewing boots and shoes*, in which the stroke of the needle is automatically varied by the variation in the thickness of the material, so that each stitch will be drawn tight. The invention consists in devices operated by the presser-foot to limit the upward stroke of the needle, and in a spring device attached to the horn for retaining the looper in the proper position relative to the needle. The needle-bar is hung on a rocking lever supported on a vertical standard which rests at its lower end on a bevelled slide block. The slide block is connected by a crank lever with the presser-foot, so that the slide-block is moved thereby to raise and lower the needle-carrying standard. The horn is fitted with a piece forming the bed and containing the looper.

An *improved saw-filing machine* has been patented by Mr. Philip Bossert, of Lebeck, Mo. The invention consists in pivoting the file holder to a bar adapted to slide horizontally in a swinging frame that is pivoted to a carriage which slides parallel to the saw clamp.

An *improved bob sleigh* has been patented by Mr. Charles R. Walkley, of Churubusco, Ind. This invention consists in a novel construction of the knee, and the arrangement thereof with regard to the runner and the bolster, and of the runner with relation to the knee and to the draught bar, whereby provision is made for enabling the runners of each pair to move independently.

Mr, James Lidstone, of Farmington, Me., has patented a *steam cooker* for cooking meats, vegetables, &c. The novelty consists in the arrangement of parts whereby the steam and odours of the cooking food are conducted from the several parts of the cooker into the fire space below, and thereby prevented from escaping into the room.

Technical Education.—Lord Selborne, as chairman of the Council of the City and Guilds of London Institute, has issued a letter to the Masters of the city companies asking for increased support and association with the work of that body. His lordship says: "It can no longer be denied that in many instances foreign manufacturers are competing with those of England to an extent that drives our products from continental markets, and even successfully rivals them in the United Kingdom itself. Those who have studied the causes of this successful competition of the foreigner concur in agreeing that prominent among these causes are the opportunities afforded for obtaining an excellent technical education in most parts of the Continent of Europe, and the want in our own country of any sufficient training of a similar kind. To give a single instance of the intelligent and thoughtful care bestowed abroad on this subject, the Polytechnic at Zurich, established upwards of twenty years ago at a cost of £100,000, is upheld at an annual charge of £18,000, a charge which, having regard to the difference between the rates of remuneration in Switzerland and in England, would represent a much larger expenditure here, and yet this original large expenditure and this heavy annual charge are willingly borne by a nation the whole population of which is about equal to that of London. The success of this establishment has been great, and the benefits it has conferred on Swiss industry are beyond dispute. In England, on the other hand, it is even now difficult to point to any proper provision for technical education. Feeling deeply the need there was to supply this great want, certain of the livery companies united themselves together and founded the City and Guilds of London Institute, being assured that in so doing they were interesting themselves in work, and were devoting their funds to objects which were most truly within their functions, having regard to the connection subsisting between them and the industries and trades of England.

At Moscow the fifteenth Exhibition of Manufactures and Artistic Productions will be held from the 15th May to the 15th of September, 1881.

The Solar Heat Engine.—M. Pifre, a French engineer, has so far improved on the apparatus invented by M. Mouchot for using the solar heat rays for practical purposes, that he states he obtains 80 per cent. of the available sun's heat in Paris, which is equivalent to a gain of 30 per cent. in efficiency.